

CLAIMS

What is claimed is:

1. A vacuum gas oil boiling range fraction comprising a T10 distillation point of 350°C or more, a T90 distillation point of 525°C or less, a density at 15°C of 890 kg/m³ or less, a sulfur content of 0.3 wt% or less, a weight ratio of aliphatic sulfur to total sulfur of 0.2 or more, and a CCAI of 790 or less.
2. The vacuum gas oil boiling range fraction of claim 1, wherein the vacuum gas oil boiling range fraction comprises a weight ratio of basic nitrogen to total nitrogen of 0.2 or more.
3. The vacuum gas oil boiling range fraction of claims 1-2, wherein the vacuum gas oil boiling range fraction comprises a kinematic viscosity at 50°C of 45 cSt or less, or wherein the vacuum gas oil boiling range fraction comprises a viscosity index of 80 or more, or a combination thereof.
4. The vacuum gas oil boiling range fraction of claims 1-3, wherein the vacuum gas oil boiling range fraction comprises a weight ratio of naphthenes to aromatics of 1.0 or more.
5. The vacuum gas oil boiling range fraction of claims 1-4, wherein the vacuum gas oil boiling range fraction comprises 40 wt% or more of naphthenes.
6. The vacuum gas oil boiling range fraction of claims 1-5, wherein the vacuum gas oil boiling range fraction comprises a nitrogen content of 950 wppm or less, or wherein the vacuum gas oil boiling range fraction comprises a pour point of 20°C or more, or a combination thereof.
7. A fuel composition comprising 10 vol% to 45 vol% of a distillate fraction and 55 vol% to 90 vol% of an vacuum gas oil fraction, wherein the vacuum gas oil fraction comprises a T90 distillation point of 525°C or less, a density at 15°C of 890 kg/m³ or less, a sulfur content of 0.3 wt% or less, and a weight ratio of aliphatic sulfur to total sulfur of 0.2 or more.
8. The fuel composition of claim 7, wherein the vacuum gas oil fraction comprises a kinematic viscosity at 50°C of 15 cSt or more, a CCAI of 790 or less, or a combination thereof.
9. The fuel composition of claims 7-8, wherein the distillate fraction comprises a renewable distillate fraction, and wherein the renewable distillate fraction comprises one or more of biodiesel, fatty acid alkyl ester, and hydrotreated vegetable oil; or wherein the renewable distillate comprises a distillate made, processed or a combination thereof using a renewable energy source; or wherein the renewable distillate comprises a distillate formed from processing of biologically derived waste, or a combination thereof.
10. The fuel composition of claims 7-9, wherein the fuel composition comprises a pour point of 30°C or less.

11. The fuel composition of claims 7-10, wherein the vacuum gas oil fraction comprises a naphthenes to aromatics ratio of 1.0 or more, or wherein the vacuum gas oil fraction comprises 40 wt% or more of naphthenes, or a combination thereof.
12. A vacuum resid boiling range fraction comprising a T10 distillation point of 500°C or more, a density at 15°C of 950 kg/m³ or less, a sulfur content of 0.4 wt% or less, a weight ratio of aliphatic sulfur to total sulfur of 0.2 or more, and a CCAI of 790 or less.
13. The vacuum resid boiling range fraction of claim 12 including a weight ratio of naphthenes to aromatics of 0.35 or more, 24 wt% or more of naphthenes, or a combination thereof.
14. The vacuum resid boiling range fraction of claims 12-13 including 2.0 wppm or more of sodium, 5 wppm or more of calcium, a weight ratio of basic nitrogen to total nitrogen of 0.2 or more, or a combination thereof.
15. A fuel composition comprising:
 - 25 vol% to 75 vol% of a vacuum resid fraction and 25 vol% to 75 vol% of a distillate fraction, a cracked distillate fraction, or a combination thereof,
 - wherein the fuel composition comprises a density at 15°C of 950 kg/m³ or less, a sulfur content of 0.5 wt% or less, a CCAI of 820 or less, and a pour point of 30°C or less, and
 - wherein the vacuum resid fraction comprises a density at 15°C of 950 kg/m³ or less, a sulfur content of 0.4 wt% or less, a weight ratio of aliphatic sulfur to total sulfur of 0.2 or more, and a CCAI of 790 or less.
16. The fuel composition of claim 15, wherein the vacuum resid fraction comprises a weight ratio of naphthenes to aromatics of 0.35 or more, or wherein the vacuum resid fraction comprises 24 wt% or more of naphthenes, or a combination thereof.
17. The fuel composition of claims 15-16, wherein the fuel composition comprises a sulfur content of 0.1 wt% or less, or wherein the vacuum resid fraction comprises a sulfur content of 0.1 wt% or less, or a combination thereof.
18. The fuel composition of claims 15-17, wherein the fuel composition comprises a pour point of 30°C or less.
19. The fuel composition of claims 15-18, wherein the distillate fraction comprises a renewable distillate fraction, the fuel composition comprising 25 vol% to 70 vol% of the renewable distillate fraction and 30 vol% to 75 vol% of the vacuum resid fraction.
20. The fuel composition of claims 15-19, wherein the vacuum resid fraction comprises 2.0 wppm or more of sodium, 5 wppm or more of calcium, a weight ratio of basic nitrogen to total nitrogen of 0.2 or more, or a combination thereof.

21. A marine fuel composition comprising a T10 distillation point of 150°C to 230°C, a T90 distillation point of 350°C to 425°C, a kinematic viscosity at 40°C of 2.0 cSt to 4.0 cSt, a sulfur content of 0.07 wt% or less, a weight ratio of aliphatic sulfur to total sulfur of 0.2 or more, and a cetane index of 45 or more.
22. The marine fuel composition of claim 21, wherein the marine fuel composition comprises a flash point of 60°C or more, a density at 15°C of 810 kg/m³ to 835 kg/m³, a kinematic viscosity at 40°C of 2.5 cSt to 3.2 cSt, or a combination thereof.
23. The marine fuel composition of claims 21-22, wherein the marine fuel composition comprises a weight ratio of naphthenes to aromatics of 2.5 or more, a naphthenes content of 40 wt% or more, or a combination thereof.
24. The marine fuel composition of claims 21-23, wherein the marine fuel composition comprises a nitrogen content of 200 wppm or less; or wherein the marine fuel composition comprises an acid number of 0.02 to 0.07 mg KOH /g; or wherein the marine fuel composition comprises a pour point of 0°C or less; or a combination thereof.
25. A method for forming a fuel composition, comprising:
fractionating a whole crude or crude fraction to form a vacuum gas oil fraction comprising a T10 distillation point of 350°C or more, a T90 distillation point of 525°C or less, a density at 15°C of 890 kg/m³ or less, a sulfur content of 0.3 wt% or less, a weight ratio of aliphatic sulfur to total sulfur of 0.2 or more, and a CCAI of 790 or less.
26. The method of claim 25, further comprising blending 10 vol% to 50 vol% of a resid-containing fraction with 50 vol% to 90 vol% of the vacuum gas oil fraction to form a blended fuel oil composition comprising a sulfur content of 0.5 wt% or less.
27. The method of claims 25-26, further comprising blending 10 vol% to 45 vol% of a distillate fraction with 55 vol% to 90 vol% of the vacuum gas oil fraction to form a blended fuel composition comprising a sulfur content of 0.5 wt% or less.
28. The method of claim 27, wherein the distillate fraction comprises a renewable distillate fraction.
29. The method of claims 25-28, wherein the blended fuel composition comprises a pour point of 30°C or less.
30. A method for forming a residual fuel or fuel blending product comprising:
blending 25 vol% to 75 vol% of a vacuum resid fraction and 25 vol% to 75 vol% of a distillate fraction, a cracked distillate fraction, or a combination thereof,
wherein the fuel composition comprises a density at 15°C of 950 kg/m³ or less, a sulfur content of 0.5 wt% or less, a CCAI of 820 or less, and a pour point of 30°C or less, and

wherein the vacuum resid fraction comprises a density at 15°C of 950 kg/m³ or less, a sulfur content of 0.35 wt% or less, a weight ratio of aliphatic sulfur to total sulfur of 0.2 or more, and a CCAI of 780 or less.

31. The method of claim 30, wherein the distillate fraction comprises a renewable distillate fraction, and wherein the fuel composition comprises 25 vol% to 70 vol% of the renewable distillate fraction and 30 vol% to 75 vol% of the vacuum resid fraction.

32. A method for forming a fuel composition, comprising:

fractionating a whole crude or crude fraction to form a fraction comprising a T10 distillation point of 150°C to 230°C, a T90 distillation point of 350°C to 425°C, a kinematic viscosity at 40°C of 2.0 cSt to 4.0 cSt, a sulfur content of 0.07 wt% or less, a weight ratio of aliphatic sulfur to total sulfur of 0.2 or more, and a cetane index of 49 or more.